THE APPLICATION OF CHECK-ALL-THE-THAT-APPLY (CATA) CONSUMER PROFILING TO PREFERENCE MAPPING OF VANILLA ICE CREAM AND ITS COMPARISON TO CLASSICAL EXTERNAL PREFERENCE MAPPING

Youngseung Lee, Lauren Dooley & Jean-François Meullenet
Introduction

Quantitative consumer research is a key tool in R&D

Overall consumer impression of products usually quantified on hedonic scale
- Hedonic ratings only because consumers cannot explain what they like
- Others have consumers rate specific attributes for intensity or appropriateness

Intensity or appropriateness ratings used to explain consumer hedonic ratings
Introduction

Ballots with intensity ratings can become very cumbersome when many products are evaluated.

Intensity scaling can be a difficult concept for consumers.

Intensity or appropriateness questions can have impact on hedonic ratings.
Introduction

Check all attributes that describe this sample:

- Buttery
- Sweet
- Milk/dairy flavor
- Custard/eggy flavor
- Corn Syrup
- Artificial vanilla
- Natural vanilla
- Creamy Flavor
- Soft
- Hard
- Gummy
- Icy
- Creamy/Smooth

CATA is a compromise between only liking and asking intensity ratings
Previous CATA research

**Advantages and uses of check-all-that-apply response compared to traditional scaling of attributes for salty snacks**
J. Adams, A. Williams, B. Lancaster, M. Foley; *Frito Lay, USA* Rose Marie Pangborn Sensory Science Symposium, 2007

**Type of methodology allowing a more instinctive description of the main sensory properties of the product tested**

**Type of question which can be about attributes, product usage or concept fit**

<table>
<thead>
<tr>
<th>Product Attributes</th>
<th>Concept Deliverables</th>
<th>Occasion/Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet</td>
<td>Indulgent</td>
<td>As a meal</td>
</tr>
<tr>
<td>Salty</td>
<td>Energizing</td>
<td>As a snack</td>
</tr>
<tr>
<td>Creamy</td>
<td>Comforting</td>
<td>While driving</td>
</tr>
<tr>
<td>Soft</td>
<td>Artificial</td>
<td>Watching TV</td>
</tr>
<tr>
<td>Tough</td>
<td>Bland</td>
<td>After exercising</td>
</tr>
</tbody>
</table>
Objectives

1. to evaluate the use of check-all-that-apply CATA data for the creation of preference maps

2. to compare CATA maps to classical internal and external mapping generated from traditional sensory profiles
Methods

1. Consumer and Sensory Testing

2. Preference Mapping

3. Comparison of Preference Mapping Outcomes
Consumer and Sensory Testing

1. 10 commercial vanilla ice cream products retailed in the United States
2. 80 consumers tested products over two sessions
3. Complete randomized design balanced for presentation order
4. Consumers answered an overall liking question using the 9-point verbal hedonic scale as well as a check-all-that-apply question with 13 attributes describing the sensory attributes of vanilla ice cream
5. Products profiled by a trained descriptive panel (17 individuals) according to 23 attributes in two replications
## Vanilla Ice Creams

<table>
<thead>
<tr>
<th>Brand</th>
<th>Name/Description</th>
<th>Fat Content</th>
<th>Flavor</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ben &amp; Jerry’s</td>
<td>Vanilla</td>
<td>24%</td>
<td>Natural</td>
<td>Ben &amp; Jerry’s Homemade Holdings, Inc. (Unilever)</td>
</tr>
<tr>
<td>Best Choice</td>
<td>Vanilla</td>
<td>11%</td>
<td>Artificial</td>
<td>Harps Stores Inc.</td>
</tr>
<tr>
<td>Blue Bell</td>
<td>Homemade vanilla</td>
<td>13%</td>
<td>Natural &amp; Artificial</td>
<td>Blue Bell Creameries</td>
</tr>
<tr>
<td>Blue Bunny</td>
<td>Premium all natural vanilla</td>
<td>10%</td>
<td>Natural &amp; Artificial</td>
<td>Wells' Dairy, Inc.</td>
</tr>
<tr>
<td>Breyers</td>
<td>Natural vanilla</td>
<td>12%</td>
<td>Natural</td>
<td>Unilever</td>
</tr>
<tr>
<td>Edy’s “Grand”</td>
<td>Rich &amp; creamy vanilla</td>
<td>5%</td>
<td>Natural</td>
<td>Nestlé</td>
</tr>
<tr>
<td>Great Value</td>
<td>Vanilla</td>
<td>11%</td>
<td>Artificial</td>
<td>Wal-Mart Stores Inc.</td>
</tr>
<tr>
<td>Guilt Free</td>
<td>Vanilla</td>
<td>4%</td>
<td>Natural &amp; Artificial</td>
<td>Yarnell Ice Cream Co.</td>
</tr>
<tr>
<td>Häagen-Dazs</td>
<td>Vanilla</td>
<td>28%</td>
<td>Natural</td>
<td>Nestlé</td>
</tr>
<tr>
<td>Yarnell’s</td>
<td>Homemade vanilla</td>
<td>15%</td>
<td>Natural &amp; Artificial</td>
<td>Yarnell Ice Cream Co.</td>
</tr>
</tbody>
</table>
### CATA Question

**Check all attributes that describe this sample:**

- Buttery
- Sweet
- Milk/dairy flavor
- Custard/eggy flavor
- Corn Syrup
- Artificial vanilla
- Natural vanilla
- Creamy Flavor
- Soft
- Hard
- Gummy
- Icy
- Creamy/Smooth
Preference Mapping

Three flavors of preference mapping employed:

- External preference mapping (Danzart, 2004) using the descriptive profiles as basis of the sensory space
- Same as above but CATA attribute counts used to create the sensory space
- Internal map constructed following Euclidian Distance Ideal Point Modelling (Meullenet et al., 2007). Preference space determined from overall liking scores

Group ideals determined for all three methods:

- Coordinates in sensory, CATA or preference spaces
- Profiles of ideal points in terms of CATA determined by multiple regression
Multiple Factor Analysis

The counts for each of the 13 attributes in the check-all-that-apply question were compared to the descriptive profiles via Multiple Factor Analysis (MFA), using FactoMineR in R ©2008, v.2.6.2.

Commercial products and group ideals coordinates on the first 2 dimensions for the three preference maps analyzed for similarity by MFA.
<table>
<thead>
<tr>
<th>Brand</th>
<th>Soft</th>
<th>Hard</th>
<th>Gummy</th>
<th>Icy</th>
<th>Creamy/Smooth</th>
<th>Buttery</th>
<th>Sweet</th>
<th>Milk/dairy flavor</th>
<th>Custard/Eggy Flavor</th>
<th>Corn Syrup</th>
<th>Natural Vanilla</th>
<th>Artificial Vanilla</th>
<th>Creamy flavor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Bell</td>
<td>42</td>
<td>20</td>
<td>5</td>
<td>37</td>
<td>31</td>
<td>44</td>
<td>58</td>
<td>60</td>
<td>45</td>
<td>10</td>
<td>25</td>
<td>39</td>
<td>45</td>
</tr>
<tr>
<td>Blue Bunny</td>
<td>37</td>
<td>20</td>
<td>7</td>
<td>16</td>
<td>45</td>
<td>46</td>
<td>53</td>
<td>58</td>
<td>35</td>
<td>13</td>
<td>28</td>
<td>33</td>
<td>51</td>
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<tr>
<td>Ben &amp; Jerry’s</td>
<td>21</td>
<td>31</td>
<td>7</td>
<td>22</td>
<td>34</td>
<td>29</td>
<td>53</td>
<td>50</td>
<td>28</td>
<td>16</td>
<td>27</td>
<td>29</td>
<td>44</td>
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<tr>
<td>Best Choice</td>
<td>29</td>
<td>29</td>
<td>4</td>
<td>28</td>
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<td>43</td>
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<td>62</td>
<td>32</td>
<td>13</td>
<td>34</td>
<td>33</td>
<td>54</td>
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<tr>
<td>Breyers</td>
<td>8</td>
<td>43</td>
<td>7</td>
<td>61</td>
<td>10</td>
<td>17</td>
<td>57</td>
<td>52</td>
<td>25</td>
<td>11</td>
<td>37</td>
<td>37</td>
<td>24</td>
</tr>
<tr>
<td>Edy’s “Grand”</td>
<td>25</td>
<td>38</td>
<td>4</td>
<td>20</td>
<td>35</td>
<td>39</td>
<td>61</td>
<td>59</td>
<td>26</td>
<td>16</td>
<td>28</td>
<td>43</td>
<td>53</td>
</tr>
<tr>
<td>Great Value</td>
<td>51</td>
<td>11</td>
<td>12</td>
<td>8</td>
<td>59</td>
<td>38</td>
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<td>21</td>
<td>12</td>
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<td>31</td>
<td>52</td>
</tr>
<tr>
<td>Guilt Free</td>
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<td>22</td>
<td>3</td>
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<td>60</td>
<td>54</td>
<td>22</td>
<td>15</td>
<td>24</td>
<td>42</td>
<td>47</td>
</tr>
</tbody>
</table>
MFA of CATA and Descriptive

- Overall good agreement between sensory and CATA profiles
- e.g. Soft hard opposite and sensory hardness perpendicular
- Agreement for icy, sweet, buttery, soft and rate of melt

**Correlation circle**

- Dim 1 (31.96 %)
- Dim 2 (19.24 %)

**CATA**
- Hardness.Oral
- Caramelized
- Woody
- Stick
- Milk
- Caramelized

**Descriptive**
- Sweet
- Bitter
- Sour
- Salt
- Vanilla
- Vanillin
- Cooked
- Milk
- Milky
- Soy
- NFDM
- Caramelized
- Oxidized
- Woody
- Stick
- Astringent
- Vanilla
- Vanillin
- Sour
- Sweet
- Cuspond.Eggy
- Oxidized
- Scoopability
- Scoopability2
- Smoothness
- Buttery
- Milk.dairy.
- flavor
- Natural
- Vanilla
- Artificial
- Vanilla
- Corn.
- Syrup
- Custard
- Eggy
CATA based external map

Group Ideal closest to products Blue Bell and Best Choice

78% of consumers satisfied by the Ideal

Average $R^2$ for consumers $=0.61$
Descriptive based external map

**Ideal Point closest to Eddy's**

**Average R²=0.59 for consumers**

**76% of consumers satisfied by this ideal**
Modeling Comparison

The first 2 dimensions explained a similar amount of the variability (59% CATA vs. 50% DA)

Average consumer fit equivalent for CATA map ($R^2=0.61$) and DA map ($R^2=0.59$)
MFA on product & ideal configurations

Dimensions 1 and 2 for three methods are highly correlated

Good agreement between Internal, external and CATA

Product configuration more similar for CATA and Internal
MFA on product & ideal configurations

- Product configurations not identical but somewhat similar
- Ideal location fairly stable and closest to F and A
- Greatest disagreement among methods for products J, F and A

![Individual factor map](image)

- Dim 1 (46.32%)
- Dim 2 (34.24%)

Legend:
- Descriptive
- CATA
- Internal
MFA on product & ideal configurations

Dim 1 (46.32 %)

Dim 2 (34.24 %)

Groups representation

Product
CATA
Internal
Descriptive

CATA more similar to internal map than to external descriptive map
Ideal CATA Profiles

CAT A attributes projected in all 3 spaces and Ideal point normalized CATA determined

Positive drivers: soft, milky/dairy, buttery, creamy flavor, natural vanilla (CATA space)
CATA attributes fits in spaces

- CATA attributes not as well fitted in preference space (EDIPM)
- Most CATA attributes well fitted in sensory space (DA)

![CATA attributes bar chart]

- CATA Custard/Eggy Flavor
- CATA Corn Syrup
- CATA Artificial Vanilla
- CATA Natural Vanilla
- CATA Creamy flavor
- CATA icy
- CATA Creamy/Smooth
- CATA Buttery
- CATA Sweet
- CATA Milk/dairy flavor
- CATA Soft
- CATA Hard
- CATA Gummy

RSQ
Conclusions

Overall
- CATA attribute data applied to preference mapping gave similar results to internal and external preference mapping

Advantage of CATA
- Task asked of consumers is simple (i.e., when compared to intensity ratings)
- Responses may be more spontaneous than when intensities are rated

Limitation of CATA
- Optimal profile derived from the check-all-that-apply maps is in terms of response counts and not intensities as given by a trained panel
Future Research

- Investigate means of term generation for CATA terms (e.g., qualitative research, focus groups)
- Assess the impact of term order and number of terms on frequency counts
- Incorporate deliverables and usage terms into mapping techniques